Original Research

Studies on Sensory, Textural Profile and Chemical Quality of Buffalo Milk *Shrikhandwadi*

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Abstract

Study was undertaken to ascertain the effect of different process, sugar level, skim milk powder on sensory qualities, texture profile and proximate composition of shrikhandwadi. Shrikhandwadi was prepared by blending standardized buffalo milk with or without incorporation of skim milk powder and with addition of sugar in different forms at varying levels (sugar blend S_1-125%, S_2-150%, S_3-175%, S_4-200%; dry sugar S_1-75%, S_2-100%, S_3-125%, S_4-150%; sugar syrup S_1-75%, S_2-100%, S_3-125%, S_4-150%) in proportion to the weight of chakka. Sensory evaluation results recorded significantly ($P \leq 0.05$) maximum sensory score for color and appearance 7.6 in the product added with 125% blend sugar (S_1) a compare to other treatments however body and texture, flavor significantly higher in 150% blend sugar. Further skim milk powder added shrikhandwadi sensory score was significantly ($P \leq 0.05$) higher than without added skim milk powder shrikhandwadi. In chakka with skim milk and dry sugar added treatment 100% sugar recorded significantly ($P \leq 0.05$) higher score. Shrikhanwadi prepared by blending sugar syrup containing 100 % sugar (S_2) exhibited significantly ($P \leq 0.05$) higher sensory scores. Results of texture analysis recorded significantly ($P \leq 0.05$) maximum values for 150% sugar for hardness 160.10mN, springiness 2.10mm, gumminess 5.00mN and chewiness 10.50 mNmm than 100% dry sugar. Proximate composition results observed significantly ($P \leq 0.05$) higher protein in skim milk powder added sample and maximum fat content was recorded in the 100% sugar syrup.

Key words: Buffalo Milk, Proximate Analysis, Sensory Analysis, *Shrikhandwadi*, Texture Profile

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Introduction

India has a very rich variety of fermented foods prepared from milk, cereals, pulses vegetables, fruits and fish. Milk and milk products like curd, buttermilk, lassi and shrikhand is inseparable dish in a regular diet of Indians. Shrikhand is a very popular and delicious product liked by many Indian and is consumed it regularly during various occasions due to its pleasant taste and aroma (Jain *et al.*, 1998). Because of this, shrikhand has a good market value and manufactured with different brands. The word shrikhand derives its name from the Sanskrit word *"Shrikharini"* meaning curd preparation with added sugar, flavoring agent, fruits and nuts (Mane *et al*., 2017). Shrikhand is delicious and delightful dessert of western India. It has the nutritive goodness of fermented milk products (Kulkarni *et al*., 2006). The dish is very popular in Gujarat, Maharashtra and Karnataka. The keeping quality of shrikhand largely depends upon its initial micro flora like yeast, mould and other microorganism. Under ambient condition (30°C) it tends to spoil within 2-3 days (Sarkar and Mishra, 1997). Under refrigerated condition (5°C) it can be kept for 40 days without deterioration. So, in order to increase the milk availability during lean periods (summer months) the shrikhand preparation is best under Indian condition. With the adoption of advanced technology, the product is being commercially prepared and marketed by the organized sector of dairy industry but with the limited success (Patel, 1997). Alternative approach to enhance the shelf life of shrikhand is to reduce down the moisture and to convert it into solid confection which can last for longer period of time. Generally buffalo milk is used for manufacture of chakka which gives higher overrun and receives consumer's preference. However, cow milk production is increasing at faster rate during last 5-6 years due to increase in crossbred cows. Surplus cow milk is available in cities as well as household level in village for conversion of milk into milk products. But there are problems of getting satisfactory yields of shrikhand prepared from cow milk due to low fat and total solids of milk.

Shrikhandwadi is a solid confection obtained by blending or chakka with sugar and desiccating the content to a semi hard mass which can cut into sizeable pieces (Bramhapurkar *et al*., 2007). Addition of increased sugar content in the blend not only serves as a sweetening agent but also increase the shelf life by retarding the development of oxidized flavor under favorable atmospheric conditions (Aneja and Vyas, 1987). Earlier few attempts were made to optimize the process of making *shrikhandwadi,* but with the limited success. Since the literature on process standardization innovation of *shrikhandwadi* is scanty, the present investigation was undertaken.

Materials and Methods

The chakka obtained from buffalo milk curd was divided in different lots according to treatments. Three methods of processing were followed- 1) blended chakka, sugar and skim milk powder was heated at 90˚C in an open pan with continuous stirring 2) chakka was heated with continuous stirring and ground sugar

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was added at the end of process 3) chakka was blended with hot sugar syrup and partially thickened. In each method of process four level of sweetener (sugar) taken as 1) sugar blend S_1-125%, S_2-150%, S_3-175%, S_4-200% 2) dry sugar S_1-75%, S_2-100%, S_3-125%, S_4-150% 3) sugar syrup S_1-75%, S_2-100%, S_3-125%, S_4-150%.

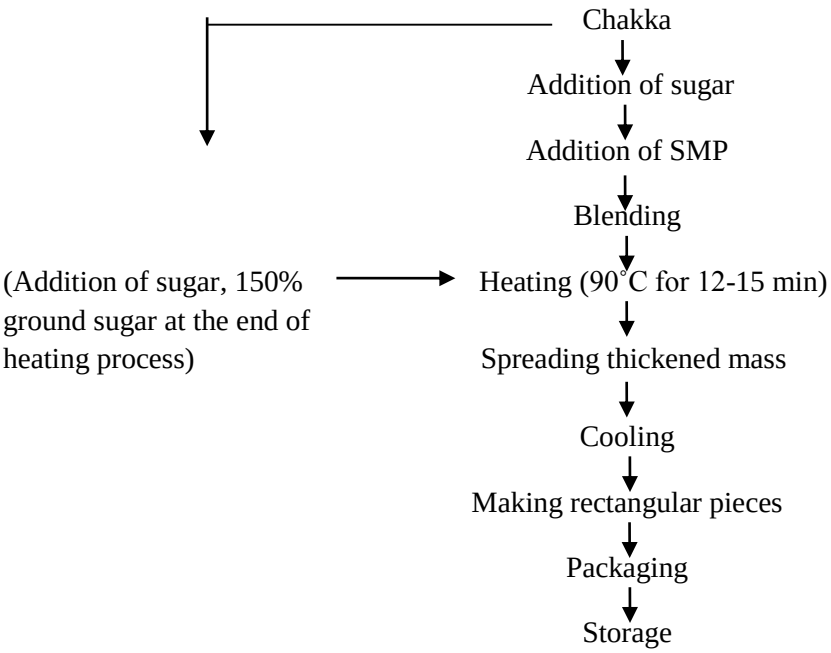

Fig. 1: Flowchart of making *Shrikhandwadi*

The texture profile was measured by subjecting samples of *shrikhandwadi* to 50 % compression on Instron Universal Testing Machine (Model -1000) as per the method described by Bourne (1966). Proximate analysis was carried as per the procedures followed by standard AOAC methods. Moisture, ash and protein (AOAC, 2005), fat (AOAC, 1997) and total solids calculated by evaporating moisture and residue was weighed. Total carbohydrates content from s*hrikhandwadi* sample was calculated by difference. Sensory analysis was done by following 9 point hedonic scale developed by quarter, master, food and container Institute, USA (Gupta, 1976) for the following sensory attributes- 1) color and appearance 2) body and texture 3) flavor and 4) overall acceptability.

Statistical Analysis

The data obtained during the course of investigation were subjected to statistical analysis using Randomized Block Design with five replications as per the method suggested by Snedecor and Cochran (1967).

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Results and Discussion

Sensory Quality

The data on the sensory quality of *shrikhandwadi* made by blending buffalo milk chakka with different sugar levels are presented in Table 1 to 6. Study recorded significantly (P≤0.05) higher color and appearance score in 125% sugar (Table 1) than other treatments. However, for body and texture and flavor of 150% sugar (S_2) recorded significantly (P≤0.05) higher score. Significantly (P≤0.05) lowest score for all the attributes were recorded in the product added with 200% sugar (S_4). The skim milk powder added buffalo milk *shrikhandwadi* (Table 2) recorded significantly (P≤0.05) higher score for color and appearance, body and texture and overall palatability in 125% (S_1) and 150% (S_2) treatment than other. The lowest scores for all the sensory attributes were recorded in the product with 200% sugar (S_4). With increased in concentration of sugar from 175 to 200% the sensory score was decreased significantly (P≤0.05).

Table 1: Effect of blending different sugar levels on sensory quality of buffalo milk

Sugar Blend (%)	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
125 (S_1)	7.6^{a}	7.6^{ab}	7.2^{ab}	7.4^{a}
150 (S_2)	7.4^{ab}	8.0^{a}	7.4^{a}	7.4^{a}
175 (S_3)	6.8^{bc}	7.2^{b}	6.6^{b}	7.0^{ab}
200 (S_4)	6.2^{c}	6.2^{c}	5.8^{c}	6.2^{b}
SE ±	0.204	0.337	0.204	0.294
C.D.	0.628	1.036	0.628	0.906

(125% Sugar blend (S1), 150% Sugar blend (S2), 175% Sugar blend (S3), 200% Sugar blend (S4)

Table 2: Effect of blending different sugar levels along with 10% skim milk on sensory quality of buffalo milk *shrikhandwadi*

Sugar Blend (%)	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
125 (S_1)	7.6^{a}	7.4^{a}	7.4	7.4^{a}
150 (S_2)	7.2^{a}	7.6^{a}	7	7.2^{ab}
175 (S_3)	6.2^{b}	6.4^{b}	6.6	6.6^{b}
200 (S_4)	5.8^{b}	5.8^{b}	6	5.6^{c}
SE ±	0.238	0.212	0.339	0.212
C.D.	0.732	0.653	NS	0.906

(125% Sugar blend (S1), 150% Sugar blend (S2), 175% Sugar blend (S3), 200% Sugar blend (S4)

The effect of added dry sugar with different concentrations on sensory qualities was presented in Table 3 and 4. Study recorded improvement in sensory scores for appearance and body and texture were observed by increasing the dry sugar content to 100% (S_2), however, the differences were at par with S_1 (75%). Addition of still higher quantity of sugar (125%) resulted in considerable reduction in sensory scores for all sensory parameters and among all attributes, addition of 175% sugar (S_5) recorded lowest scores for all sensory qualities.

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Table 3: Effect of addition of dry sugar on sensory characteristics of buffalo milk s*hrikhandwadi*

Sugar Blend (%)	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
75 (S_1)	7.0^{ab}	7.0^{ab}	6.8	6.8
100 (S_2)	7.6^{a}	7.6^{a}	7.4	7.2
125 (S_3)	6.8^{ab}	7.0^{ab}	7	6.4
150 (S_4)	6.2^{b}	6.4^{b}	6.6	6
175 (S_5)	5.6^{b}	6.4^{b}	6.4	5.6
SE ±	0.321	0.288	0.365	0.464
C.D.	0.961	0.862	NS	NS

(75% Sugar blend (S1), 100% Sugar blend (S2), 125% Sugar blend (S3), 150% Sugar blend (S4), 175% sugar blend (S5)

Table 4 reveals highly significant (P≤0.05) differences in all the sensory attributes of *shrikhandwadi* made from buffalo milk fortified with dry sugar and skim milk powder. Significantly (P≤0.05) higher scores were recorded in the product added with 100% sugar (S_2) followed by S_1 (75%) and S_3 (125%). These treatments were however, superior in all respect, except flavor over S_4. Addition of 175% sugar (S_5) resulted in lowest sensory scores for all the attributes.

Table 4: Effect of addition of dry sugar and 10% SMP on sensory characteristics of buffalo milk *shrikhandwadi*

Sugar Blend (%)	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
75 (S_1)	7.0^{ab}	7.2^{a}	7.2^{a}	7.2^{a}
100 (S_2)	7.4^{a}	7.4^{a}	7.0^{a}	7.4^{a}
125 (S_3)	7.0^{ab}	7.2^{a}	6.8^{a}	6.8^{ab}
150 (S_4)	6.4^{b}	6.2^{b}	6.6^{a}	6.0^{b}
175 (S_5)	5.8^{b}	5.8^{b}	5.4^{b}	5.4^{c}
SE ±	0.277	0.305	0.3	0.329
C.D.	0.831	0.913	0.898	0.984

(75% Sugar blend (S1), 100% Sugar blend (S2) and 125% Sugar blend (S3), 150% Sugar blend (S4), 175% sugar blend (S5).

Shrikhandwadi prepared by blending sugar syrup (Table 5) containing 100% sugar (S_2) exhibited significantly (P≤0.05) higher sensory scores which were at par with S_1. Blending of increased amount of sugar 125% resulted in significant (P≤0.05) reduction in scores particularly in respect of flavor and overall acceptability. The lowest scores for all the sensory attributes recorded in the blend containing 150% sugar (S_4).

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Table 5: Effect of blending of hot sugar syrup on sensory quality of buffalo milk *shrikhandwadi*

Sugar Blend (%)	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
75 (S_1)	7.2	7.0^{ab}	7.4^{ab}	7.0^{ab}
100 (S_2)	7.4	7.4^{a}	7.8^{a}	7.6^{a}
125 (S_3)	7	7.4^{a}	6.8^{b}	6.4^{b}
150 (S_4)	6.2	6.4^{b}	6.0^{bc}	5.8^{bc}
SE ±	0.319	0.178	0.268	0.242
C.D.	NS	0.548	0.824	0.783

(75% Sugar blend (S1), 100% Sugar blend (S2), 125% Sugar blend (S3), 150% Sugar blend (S4)

Shrikhandwadi made by using selected sugar levels added (Table 6) directly in the form of dry sugar or blending with chakka either as ground sugar or hot sugar syrup with or without SMP showed non-significant (P>0.05) differences in all sensory attributes scores. The maximum scores for color and appearance, flavor and overall acceptability were observed in the product made from the blend containing 150% ground sugar followed by addition of 100% dry sugar at the end of process. The sensory scores for other blends were however, observed to be more or less similar.

Table 6: Effect of selected sugar blends on sensory characteristics of buffalo milk *shrikhandwadi*

Type of Sugar Blend	Color and Appearance	Body and Texture	Flavor	Overall Acceptability
150 % ground sugar	7.6	7.4	7.8	7.6
125 % ground sugar with SMP	7.6	7.4	7.2	7.2
100 % dry sugar	7.6	7.6	7.4	7.4
100 % dry sugar with SMP	7.4	7.4	7	7.2
100 % sugar syrup	7.4	7.6	7.4	7.4
S.E.±	0.11	0.11	0.241	0.321
C.D.	NS	NS	NS	NS
	7.6	7.4	7.8	7.6

Texture

It was observed from study (Fig. 2) that *shrikhandwadi* made by blending buffalo milk chakka with 150% ground sugar exhibited maximum values for hardness 160.10 mN, springiness 2.10 mm, gumminess 5.00mN and chewiness 10.50 mNmm followed by addition of 100 % dry sugar at the end of the process and 100% sugar syrup. The lowest values for all the textural attributes were recorded in skim milk powder fortified *shrikhandwadi* with 100 % dry sugar. The product made by blending of chakka with 100 % of dry sugar resulted in lower hardness 150.65 mN, but the values for cohesiveness 0.0322, springiness 1.90 mm, gumminess 4.85 mN and chewiness 9.20 mNmm were almost similar and comparable to that of the product made by blending with 150% ground sugar.

Proximate Composition

Results of proximate composition for *shrikhandwadi* made from buffalo milk chakka using selected sugar blends showed slight variations in moisture and total carbohydrates content while the differences in fat,

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protein and ash content were marginal, skim milk powder fortified product with 125% sugar exhibited lowest moisture content while the total carbohydrates content were observed to be highest.

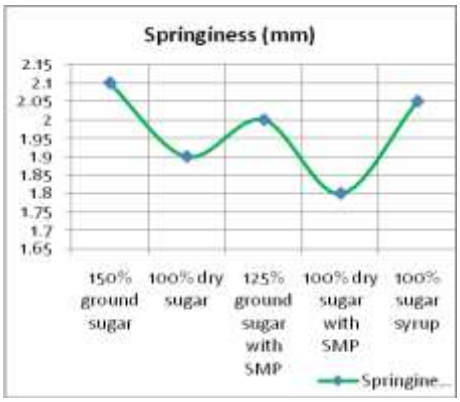

Fig. 1: Springiness (mm) of buffalo milk *Shrikhandwadi* as influenced by Chakka sugar

Fig. 2: Hardness (nM) of buffalo milk Shrikhandwadi as influenced by Chakka sugar

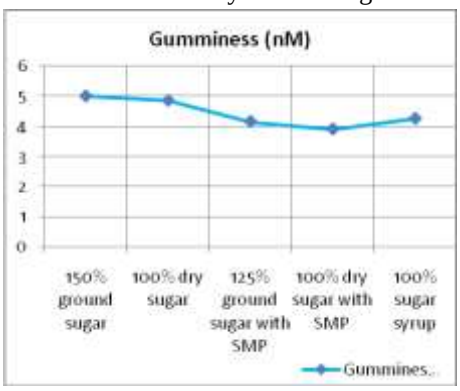

Fig. 3: Gumminess (nM) of buffalo milk *Shrikhandwadi* as influenced by Chakka sugar blends

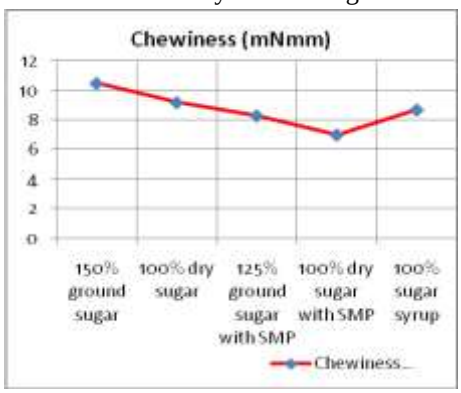

Fig. 4: Chewiness (mNmm) of buffalo milk *Shrikhandwadi* as influenced by Chakka sugar blends

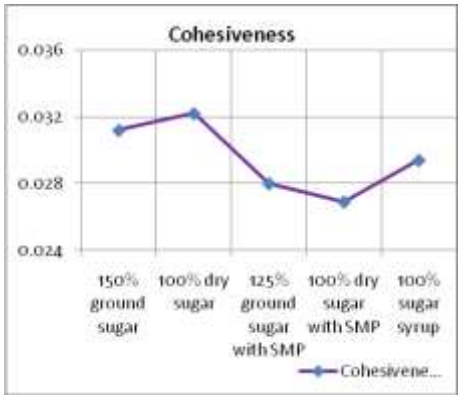

Fig. 5: Cohesiveness of buffalo milk *Shrikhandwadi* as influenced by Chakka sugar

The reverse trend in moisture and carbohydrate content was however observed for the product made with 100% dry sugar added at the end of the process. The maximum fat content recorded in the blend containing 100% sugar syrup while the maximum protein contents were in skim milk powder fortified products.

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However, the variations in the contents from different blends were narrow (non-significant P>0.05). Similar chemical composition results were recorded by Bramhapurkar *et al.* (2007) in buffalo milk *shrikhandwadi*.

Table 7: Proximate composition of *shrikhandwadi* made from buffalo milk chakka using selected sugar blend combinations

Type of Blend	Constituents (%)					
	Moisture	Total Solids	Fat	Protein	Ash	Total Carbohydrates
150% ground sugar	12.8	81.2	13.2	8.15	0.86	64.99
125% ground sugar with SMP	11.45	88.55	12.6	8.7	0.89	66.36
100% dry sugar	13.55	86.45	13	8.1	0.84	64.51
100% dry sugar with SMP	12.15	87.85	12.6	8.86	0.85	65.54
100 % sugar syrup	13	87	13.5	8.14	0.84	64.52

Conclusion

Sensory and textural properties of *shrikhandwadi* was enhanced greatly by blending of buffalo milk chakka with 150% ground sugar and 100% dry sugar at the end of process without incorporation of skim milk powder.

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